

WHAT IS CLAIMED IS:

1. A fracture reduction assembly comprising:
a reduction platform having at least one receiving hole;
a fragment manipulator having a bone engaging end and a threaded portion,
5 the manipulator having a portion which is sized to fit within the at least one receiving hole;
a nut configured to threadably engage the fragment manipulator threaded
portion and to engage a top surface of the platform.
2. The reduction assembly of claim 1, wherein the fragment manipulator has a
second end opposite the bone engaging end, and a central portion extending between the
10 bone engaging end and the second end, the central portion having a first diameter, the at
least one receiving hole having a second diameter, the second diameter being larger than the
first diameter.
3. The reduction assembly of claim 2, wherein the second end of the fragment
manipulator includes a tool engaging portion.
- 15 4. The reduction assembly of claim 3, wherein the tool engaging portion has a
coupling surface for engaging a drive assembly.
5. The reduction assembly of claim 1, wherein the bone engaging end has a
self-drilling tip.
- 20 6. The reduction assembly of claim 6, wherein the self drilling tip has a first
portion and a second portion, the first portion has threads that increase in diameter as they
move away from a tip, while the second portion has uniform diameter threads.
7. The reduction assembly of claim 1, wherein the fragment manipulator
comprises an elongated member having a length and a central cross section, the bone
engaging end has a first outer diameter, and the central cross section has a second outer
25 diameter, the second outer diameter being larger than the first outer diameter thus forming a
stop.
8. The reduction assembly of claim 1, wherein the nut further includes a nose
for engaging the top surface of the reduction platform, the nose being configured to
facilitate angular adjustment of the fragment manipulator with respect to the reduction
30 platform.

9. The reduction assembly of claim 9, wherein the nose is spherical for engaging a countersunk receiving hole formed in the top surface of the reduction platform.
10. The reduction assembly of claim 1, wherein the reduction platform has a plate-like configuration.
- 5 11. The reduction assembly of claim 11, wherein the reduction platform includes multiple receiving holes sized and configured to receive the fragment manipulator.
12. The reduction assembly of claim 12, wherein at least one of the multiple receiving holes is countersunk.
- 10 13. The reduction assembly of claim 1, wherein the reduction platform includes a plurality of support legs for supporting the reduction platform above a targeted bone region.
14. The reduction assembly of claim 14, wherein the support legs include a fixation end sized and adapted for connection with a fixation element formed in the reduction platform.
- 15 15. The reduction assembly of claim 1, wherein the reduction platform is supported above a targeted bone region by a supporting system.
16. The reduction assembly of claim 16, wherein the supporting system comprises an external frame including a head support plate and a plurality of post assemblies.
- 20 17. The reduction assembly of claim 17, further comprising an adjusting mechanism for varying the location of the post assemblies with respect to the head support plate.
- 25 18. The reduction assembly of claim 18, wherein the adjusting mechanism includes at least one sliding track adjustment assembly and at least one sliding plate sized and configured to slidably engage the sliding track to permit the position of the post assembly to be adjusted with respect to the head support plate.

19. The reduction assembly of claim 18, wherein the adjustment mechanism comprises a plurality of hole adjustment assemblies placed at various locations on the head support plate for engaging the post assemblies.

20. The reduction assembly of claim 18, wherein the adjustment mechanism
5 comprises a combination of sliding track adjustment assemblies and hole adjustment assemblies.

21. The reduction assembly of claim 17, wherein the post assembly comprises a vertical connecting post having a first end and a second end, a connecting rod having a first end and a second end, and an adjustable clamp, the first end of the vertical connecting post
10 is sized and configured to engage the head support table, the first end of the connecting rod is sized and configured to engage the reduction platform, and the second end of the vertical connecting rod and the second end of the connecting rod are sized and configured to engage the adjustable clamp.

22. The reduction assembly of claim 22, wherein the adjustment clamp is
15 configured to permit three dimensional adjustment of the reduction platform with respect to the head support plate.

23. The reduction assembly of claim 22, wherein the first end of the connecting rod is connected to the reduction platform by a universal joint.

24. The reduction assembly of claim 17, wherein the support system further
20 includes at least one head stabilizing assembly having a support plate engaging portion sized and configured to engage the head support plate and a fixation pin engaging portion sized and configured for receiving a skull fixation pin.

25. The reduction assembly of claim 1, wherein the reduction platform is a mask-like structure.

25 26. The reduction assembly of claim 26, wherein the mask-like structure includes a plurality of fixation elements sized and configured to permit connection of the mask to a support assembly for positioning the mask-like structure above the patient's skull.

27. The reduction assembly of claim 1, wherein the reduction platform is a rectangular plate having an arched profile.

28. The reduction assembly of claim 28, wherein the arched profile rectangular plate is sized and configured to extend from one side of a patient's bone to another side, with the top of the arched platform positioned over the targeted bone region.

29. The reduction assembly of claim 29, further comprising a head support table having a plurality of post assemblies, each of the post assemblies being sized and configured to engage an end of the arched profile rectangular plate.

30. The reduction assembly of claim 30, wherein each post assembly comprises a vertical connecting post having a first end sized and configured for fixation to the head support plate, and a post to platform clamp sized and adapted to interconnect the post assembly with the arched profile rectangular plate.

31. The reduction assembly of claim 1, wherein the reduction platform is a cylindrical bar.

32. The reduction assembly of claim 32, wherein the cylindrical bar includes at least a portion having a flat surface.

33. The reduction assembly of claim 32, further comprising a supporting system sized and configured to position the cylindrical bar over a targeted bone region.

34. The reduction assembly of claim 34, wherein the support system includes a head support plate and a plurality of support members having an arched profile sized and configured to extend from one side of the head support plate to another side of the head support plate, with the top of the arch support members being configured to extend over the patient's targeted bone.

35. The reduction assembly of claim 35, wherein the cylindrical bar includes a connection clamp having a first bore and a second bore, the first bore being sized and configured to receive the cylindrical bar and the second bore being sized and configured to receive the arched support member.

36. The reduction assembly of claim 35, further comprising a thumb wheel having an internally threaded sleeve for engaging an externally threaded portion on the cylindrical bar wherein the sleeve of the thumb wheel is sized and configured to be installed between the first bore and the cylindrical bar for incrementally adjusting the position of the bar with respect to the supporting system.

37. The reduction assembly of claim 1, wherein the at least one receiving hole includes an insert, the insert having an axial bore sized and configured to receive the fragment manipulator.

5 38. The reduction assembly of claim 37, wherein the insert is articulable within at least a portion of the receiving hole to permit angulation of the fragment manipulator with respect to the reduction platform.

39. The reduction assembly of claim 37, wherein the insert is an articulating washer having a nut engaging portion and a spherical portion, the nut engaging portion being sized and configured to provide a bearing surface for the nut while the spherical
10 portion is sized and configured to engage the at least one receiving hole.

40. The reduction assembly of claim 37, wherein the insert is a collar with at least one vertical slot and a spherical outer surface sized and configured to articulate within a correspondingly spherical inner surface of the at least one receiving hole.

41. A fracture reduction assembly for manipulating bone pieces comprising:
15 a reduction platform having at least one receiving hole;
a fragment manipulator having a bone engaging end, the manipulator having a portion which is sized to fit within the at least one receiving hole;
wherein at least a portion of the fragment manipulator has a threaded section configured to allow translation of the fragment manipulator through the receiving hole to
20 reduce the patient's bone.

42. The assembly of claim 41, further comprising a nut, the nut having a threaded portion configured to threadably engage the threaded section, the nut further having an exterior surface configured to engage a top surface of the platform.

43. The assembly of claim 41, wherein at least a portion of the receiving hole
25 has threads configured to threadably engage the threaded section of the fragment manipulator.

44. The assembly of claim 41, wherein the fragment manipulator has a second end opposite the bone engaging end, and a central portion extending between the bone engaging end and the second end, the central portion having a first diameter, the at least one receiving hole having a second diameter, the second diameter being larger than the first diameter.

45. The assembly of claim 44, wherein the second end of the fragment manipulator includes a tool engaging portion.

46. The assembly of claim 41, wherein the bone engaging end has a self-drilling tip.

47. The assembly of claim 41, wherein the fragment manipulator comprises an elongated member having a length and a central cross section, the bone engaging end has a first outer diameter, and the central cross section has a second outer diameter, the second outer diameter being larger than the first outer diameter thus forming a stop.

48. The assembly of claim 41, wherein the reduction platform has a plate-like configuration.

49. The assembly of claim 41, wherein the reduction platform includes a plurality of support legs for supporting the reduction platform above a targeted bone region.

50. The assembly of claim 41, wherein the support legs include a fixation end sized and adapted for connection with a fixation element formed in the reduction platform.

51. The assembly of claim 41, wherein the reduction platform is supported above a targeted bone region by a supporting system.

52. The assembly of claim 51, wherein the supporting system comprises an external frame including a head support plate and a plurality of post assemblies.

53. The assembly of claim 52, further comprising an adjusting mechanism for varying the location of the post assemblies with respect to the head support plate.

54. The assembly of claim 53, wherein the adjusting mechanism includes at least one sliding track adjustment assembly and at least one sliding plate sized and configured to slidably engage the sliding track to permit the position of the post assembly to be adjusted with respect to the head support plate.

5 55. The assembly of claim 53, wherein the adjustment mechanism comprises a plurality of hole adjustment assemblies placed at various locations on the head support plate for engaging the post assemblies.

56. The assembly of claim 53, wherein the adjustment mechanism comprises a combination of sliding track adjustment assemblies and hole adjustment assemblies.

10 57. The assembly of claim 52, wherein the post assembly comprises a vertical connecting post having a first end and a second end, a connecting rod having a first end and a second end, and an adjustable clamp, the first end of the vertical connecting post is sized and configured to engage the head support table, the first end of the connecting rod is sized and configured to engage the reduction platform, and the second end of the vertical
15 connecting rod and the second end of the connecting rod are sized and configured to engage the adjustable clamp.

58. The assembly of claim 57, wherein the adjustment clamp is configured to permit three dimensional adjustment of the reduction platform with respect to the head support plate.

20 59. The assembly of claim 52, wherein the support assembly further includes at least one head stabilizing assembly having a support plate engaging portion sized and configured to engage the head support plate and a fixation pin engaging portion sized and configured for receiving a skull fixation pin.

25 60. The assembly of claim 41, wherein the reduction platform is a mask-like structure.

61. The assembly of claim 60, wherein the mask-like structure includes a plurality of fixation elements sized and configured to permit connection of the mask to a support assembly for positioning the mask-like structure above the patient's skull.

30 62. The assembly of claim 41, wherein the reduction platform is a rectangular plate having an arched profile.

63. The assembly of claim 62, wherein the arched profile rectangular plate is sized and configured to extend from one side of a patient's bone to another side, with the top of the arched platform positioned over the targeted bone region.

5 64. The assembly of claim 63, further comprising a head support table having a plurality of post assemblies, each of the post assemblies being sized and configured to engage an end of the arched profile rectangular plate.

65. The assembly of claim 64, wherein each post assembly comprises a vertical connecting post having a first end sized and configured for fixation to the head support plate, and a post to platform clamp sized and adapted to interconnect the post assembly with
10 the arched profile rectangular plate.

66. The assembly of claim 41, wherein the reduction platform is a cylindrical bar.

67. The assembly of claim 66, wherein the cylindrical bar includes at least a portion having a flat surface.

15 68. The assembly of claim 67, further comprising a supporting system sized and configured to position the cylindrical bar over a targeted bone region.

69. The assembly of claim 68, wherein the support system includes a head support plate and a plurality of support members having an arched profile sized and configured to extend from one side of the head support plate to another side of the head support plate, with the top of the arch support members being configured to extend over the
20 patient's targeted bone.

70. The assembly of claim 69, wherein the cylindrical bar includes a connection clamp having a first bore and a second bore, the first bore being sized and configured to the receive the cylindrical bar and the second bore being sized and configured to receive the
25 arched support member.

71. The reduction assembly of claim 70, further comprising a thumb wheel having an internally threaded sleeve for engaging an externally threaded portion on the cylindrical bar wherein the sleeve of the thumb wheel is sized and configured to be installed between the first bore and the cylindrical bar for incrementally adjusting the position of the
30 bar with respect to the supporting system.

72. A method of performing craniofacial reduction comprising:
locating at least a portion of a bone to be reduced;
positioning a reduction platform over the located bone portion;
inserting a fragment manipulator through the reduction platform and into the
5 located bone portion;
threading a nut onto the fragment manipulator until the nut contacts the
reduction platform; and
continuing to rotate the nut so that the fragment manipulator is drawn up
through the nut thereby moving the located bone portion attached to the fragment
10 manipulator.
73. The method of claim 71, wherein the fragment manipulator includes a bone
engaging end and a threaded portion, the manipulator further having a portion which is
sized to fit within at least one receiving hole formed in the reduction platform.
74. The method of claim 72, wherein the nut is configured to threadably engage
15 the fragment manipulator threaded portion and also to engage a top surface of the platform.
75. The method of claim 73, wherein the nut further includes a spherical nose for
engaging the top surface of the reduction platform, the nose being configured to facilitate
angular adjustment of the fragment manipulator with respect to the reduction platform.
76. The method of claim 72, wherein the fragment manipulator further includes
20 a tool engaging portion.
77. The method of claim 72, wherein the bone engaging end has a self-drilling
tip.
78. The method of claim 71, wherein the reduction platform has a plate-like
configuration.
- 25 79. The method of claim 71, wherein the reduction platform is a mask-like
configuration.
80. The method of claim 71, wherein the reduction platform is a rectangular
plate having an arched profile.
81. The method of claim 71, wherein the reduction platform is a cylindrical bar.

82. The method of claim 80, wherein the reduction platform further comprises a support system including a head support plate and a plurality of support members having an arched profile sized and configured to extend from a first side of the head support plate to a second side of the head support plate, with the top of the arch support members being
5 configured to extend over the patient's head.

83. The method of claim 81, wherein the cylindrical bar includes a connection clamp having a first bore and a second bore, the first bore being sized and configured to receive the cylindrical bar and the second bore being sized and configured to receive the arched support member.

10 84. The method of claim 83, further comprising a thumb wheel having an internally threaded sleeve for engaging an externally threaded portion on the cylindrical bar wherein the sleeve of the thumb wheel is sized and configured to be installed between the first bore and the cylindrical bar for incrementally adjusting the position of the bar with respect to the supporting system.

15 85. The method of claim 71, wherein the reduction platform is positioned above a targeted bone region by a supporting system.

86. The method of claim 83, wherein the supporting system comprises an external frame including a head support plate and a plurality of post assemblies.

20 87. The method of claim 71, wherein the reduction platform includes a plurality of support legs for positioning the reduction platform above the targeted bone region.